Syngenegraph Part 3

A new Perspective on the Purpose of Blockchain Technology in Creating a Safe, Secure, Circular & Sustainable Global Economy for Engineers, Creatives & Blue Collar Workers.

Patrick Mockridge, James Jones & Raphaël Fabre
Metcalfe Energy, CubeSpawn & Dappy.tech
Aberystwyth, Wales; Texas, USA & Toulouse, France

Abstract

The CoVid-19 crisis represents a new opportunity to reshape out global value systems in accordance with our best available understanding or what prevents humanity from developing the necessary innovation to improve genuine quality of life. The networked systems of coordination of the 20th century, whether capitalist or socialist, were capital power structures. These structures depend upon mimetic desire, and therefore scapegoating, and sabotage in order to sustain them.

The advent of Bitcoin [58] and other blockchain solutions heralds a new vision of decentralised value networks, free from oligarchical and state control. However these networks still depend upon capitalist conceptions of money and finance and will continue to inherit the legacy problems associated with the value networks of the past if we do not build solutions which fundamentally take individual situational capital into consideration from the beginning. Decentralisation means not just decentralisation of finance but also decentralisation of how financial instruments are created from the situational capital of the individuals involved in creating them.

Decentralisation means not only decentralising the creation and transfer of money, but also decentralising the meaning of money according to the existential drivers and necessities of those involved in its creation from the work that they carry out. If we consider money to be the integral of all work and stake across a network accumulated via non-zero sum and zero sum games, we can attribute provenance to money in a way that is 10x more transparent and fair for those involved in earning it by giving up their time and their life.

I. Building the Ideal Romeo-Juliet Diagram

The Cre-Order of capital [2] perpetuates a perception diagram that deliberately warps perception in order to perpetuate stagflation.

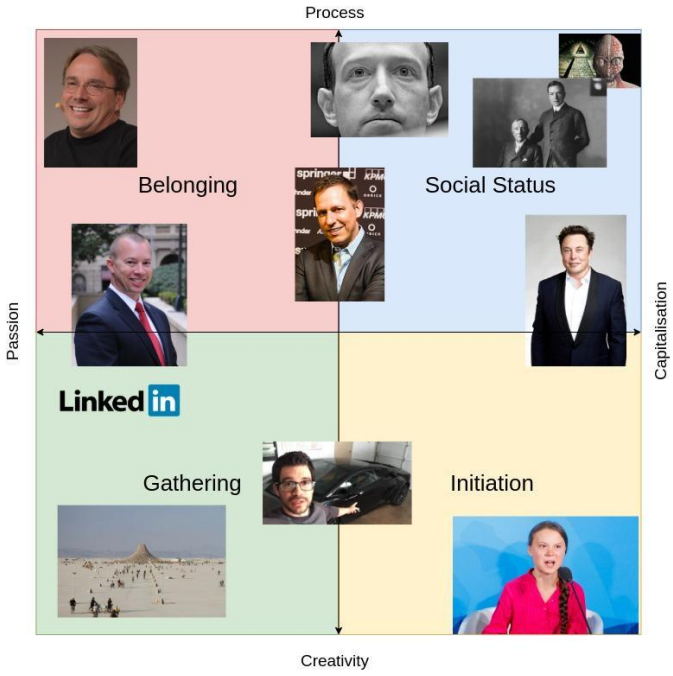

Figure 1.1: The 'Fake News' perception diagram prevents those on the green square (most people) from taking rational steps toward capitalising upon solving problems at both local and global scale.

The key thing to recognise about Figure 1.1 (the same as Figure 3.13 from part two) is that from the gathering point on the green square, Google's official music festival: Burning Man, there is no viable path to capitalisation from the change expected by the World Economic Forum's Great Reset [40] [41] agenda according to the Zero to One [1] path.

The exploration of the phase space of the Romeo-Juliet diagram throughout parts one and two of this paper has the power to change the public perception into something much more constructive. Each section of this paper will add a piece to the Syngenegraph puzzle, which is explained in the final section.

The aim is to build a robust map for 39 million new global leaders to be able to follow to the best of their ability in order to be able to meet the goal of the Great Reset within a reasonable time and budget, in a way that meets the principles of ALARP and best in class major accident legislation [37] [38] at a Dunar level [40] human scale.

II. Cube Spawn

Societies vast wealth is built on three pillars: Energy, Materials, and Technology [28].

Energy operates the Technology to extract materials from the world in the form of mining and refining. (Logging, Farming and Fishing are mining the planets biota.and follow similar rules to mining)

Additional energy is then used to fabricate or process goods, and ship them worldwide.

With increasing access to energy over the last 150 years, this model has served to create the largest expansion of human population and the greatest increase in individual well-being for a significant portion of the world's population in history.

But the environmental and societal cost is high and has brought the world to the brink of a worsening climate crisis and massive social inequality in the midst of plenty.

It is becoming increasingly apparent that a profound change to this model is needed, If society is to continue to thrive, and to bring its benefits to all people, rather than a small portion of the populace.

Human activities now dominate all aspects of the Earth's surface: These activities also take an increasing annual toll on the natural world. ($6.6 trillion by the UN's estimates for 2008)

But all of this could be changed by altering the model we use. While improving and democratizing access to the benefits of this material wealth, yet, simultaneously lowering its negative environmental impacts.

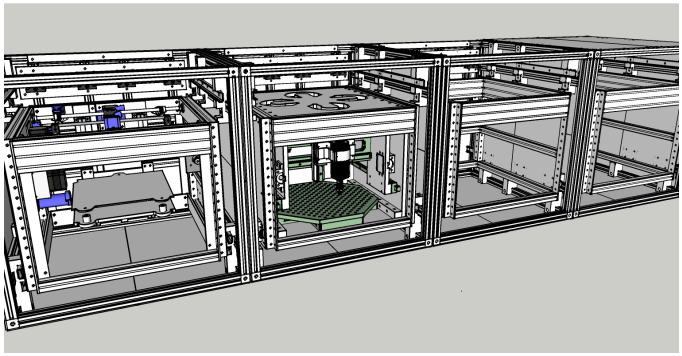

Figure 2.1: 3D model including the CubeSpawn 3D printer and milling machine.

CubeSpawn is an open source, small scale, modular, FMS (Flexible Manufacturing System)

Since it exists in both the digital and physical realms, Cubespawn offers an exciting and practical way for gamers, students and researchers to design robotic solutions, and share those designs with peers in both open source, and monetized ways.

It also offers an opportunity for gamers to see the benefits of a modular manufacturing system and interactions between multiple machines in an infinitely re-organisable robotics solution.

Manufacturing is complex, involving hundreds of specialized skills and insights that make a process work well or, in their absence , not at all. Collectively, however, the millions of industry professionals not only manage to produce millions of tons of sophisticated goods annually, but sell it profitably enough to do it again next year.

This collective knowledge enables the perpetuation of the existing business paradigm, with its legacy of 18th century linear, centralized production, labor for wages and open ended product life-cycles.

Scant attention is given to designing for recyclability, distributing in ways that don't require elaborate packaging, making things close to their markets, to reduce the environmental burden of long distance freight.

Arbitraging distant labor price differentials incurs many externalized costs, These practices lead to synthetically low product costs. But the externalized costs are real, keeping them off the balance sheet is merely self deception.

Recycling for many parts of the waste stream is

currently inefficient and many recyclable materials "fall through the cracks" due to low incentives and perceived low material values.

Automating waste processing should be a high priority, and building systems that can optimally process plastics, low volume metals and E-waste would be a priority, if the incentives were higher.

Creating the incentive to resolve these issues may lie in an unexpected direction: by creating systems that automate, and therefore simplify, (for the designer, at least) making new hardware:

As has been shown by the personal 3D printer craze, a strong desire to convert a digital design into a physical object possesses a significant portion of the technically able populace, to the degree they are willing to go to great lengths to fabricate their own machines, for the purpose of printing a staggering array of marginally useful plastic objects, while 3D printers do make many formerly impossible fabrication challenges solvable with fairly low cost machines, the technology is still not accessible to the hobbyist at any reasonable cost for high fidelity metal part production.

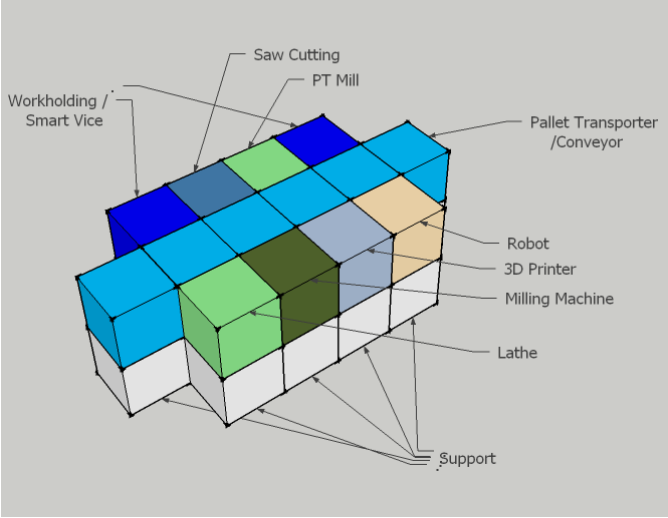

Figure 2.2: 3D diagram demonstrating the minimum viable components necessary to create a basic CubeSpawn autonomous modular factory.

And what is lacking more than this is automation and integration, nearly all the smaller machines and DIY kits on the market are for manually monitored machines, while complete automation is more difficult (and ultimately less interactive) substantial portions of core industries run "Lights out" today, and have increasingly done so for decades.

Because Cubespawn is modular, it offers a window into designing robotic solutions for both professionals and hobbyists that simplify the more technical and scientific details of robotic engineering design, without losing the ability to dig into the technology as their knowledge grows.

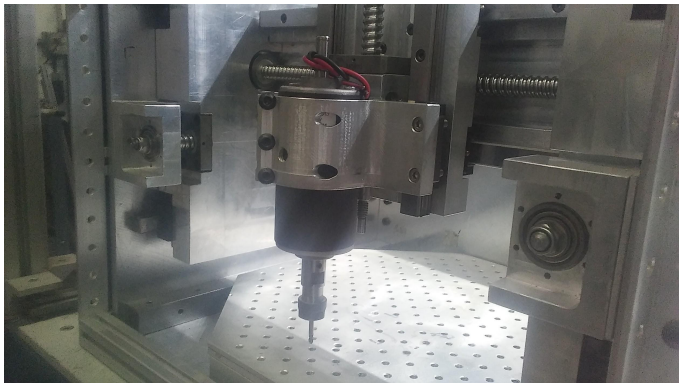

Figure 2.3: A photograph of the prototype CubeSpawn milling machine being built by James Jones.

CubeSpawn's modular nature also reduces the cost of automated manufacturing by 90% and radically improves the social and economic cost of the recycling and repurposing the machines following decommissioning.

The main goal for the CubeSpawn project is to add automated elements until the system can convert a file, called a "Digital Template" into a complex physical object, under autonomous, automatic control. This will serve to enable the creation of physical objects from designs created in Makerverse, so that robots created and tested entirely in the simulated labs can be brought into the physical world.

The initial system consists of 600mm (about 2 ft) aluminum t-slot framed cubes, but the system will scale up to larger, and down to smaller sizes.

Integrating bleeding edge DAG technology, such as RChain, would allow for trustless transactions, sidechains for verifiable performance metrics, smart contracts, and provide useful capabilities to make an autonomous manufacturing system perform instant, contractless, short run manufacturing, for varied end users.

And because RChain Rholang (see part one) is based upon the Rho Process Calculus, it is an exciting future option for encoding in robotic actuation and for encoding the necessary process calculus required for

machines to work together in parallel from silicon to metal.

Figure 2.4: Conceptual flow diagram showing the framework of the CubeSpawn operating system. The open source Robotic Operating System (ROS) is outside the scope of this paper but information is freely available via the internet. [86]

The system could theoretically collect fees from machine owners, and use those fees to incentivize free agents to procure work for the systems, hire engineering skills, pay for materials and pay for overflow production, making system capacities very fluid and responsive to varying demand.

A royalty system could provide incentive for engineering improved capabilities for a particular type of machine, and using their deep learning capabilities, even the machines might “upvote” an upgrade based on quantifiable characteristics of improved metrics for tool wear, tolerance, or throughput.

For a more broadly contextual understanding of the necessity of CubeSpawn, or something similar, in order to achieve the goals of the Great Reset, equitable resource distribution amongst humanity as a whole, the circular economy, Industry 4.0 and climate change mitigation, James Jones made a presentation for TEDx Sugarland Texas which is available to view on YouTube. [85]

Engineering data related to the CubeSpawn project is also available on Wikifactory. [84]

III. Makerverse

The idea that robotics can be developed in virtual environments without the need to resort to physical construction has been amply demonstrated in real world testing over the past thirty years. Complex robotics have been constructed in real hardware after first designing them with virtual physics and completely digital simulated environments. These mechanisms have been used for teaching, research and industrial settings to design, debug, train and construct knowledge systems which are intended for production in real world hardware. The savings in using such methods to develop robotics with iterative cycles of improvement using digital design only is astronomical over older hardware research approaches.

Carrying this concept to its logical end, it is proposed to build an online virtual world where the combined efforts of individuals working on hundreds of thousands of variations can contribute to vastly superior hardware that has been heavily debugged in evolutionary adaptations without the costs associated with real world construction. Should it be successful, the potential profit of the intellectual property from such an environment would be nearly priceless. It would have limitless value to scientific, technical, mechanical, military and social arenas worldwide. What is now done in custom funded labs at a cost of millions could instead be produced in multi-user shared cooperatives at a fraction of the cost with the final product far more tested and stable than with other approaches.

Most important of all, it could create a groundswell of enthusiasm for the adoption of robotics throughout society when the population themselves has had a hand in the design and deployment of the machines. Our goal at the outset of the project would be to make a product that is invitingly easy to use, convenient for many different levels of expertise and create a sense of ownership that would drive robotics design to all-new heights previously unimagined when the practice was confined to ersatz research funding capital.

The technological solution can be summed up in three parts:

- A simulated robotics engineering workshop
- A massive multiplayer collaborative / competitive war game
- A peer to peer marketplace of robotic engineering designs supported by RChain

Core Technology Features

- Vast online world with a starting maximum of 25K users online at once supporting up to 100K users a day
- Virtual environment relies upon real world physics and dynamics with the finest

granularity we can support

- All users possessing a virtual “garage” and construction lab for their own robot projects
- Integration with current VR glasses and gloves to enable tactile construction work by users
- The capacity to drop your robot into any arena or point on the virtual map from storage in the “garage”
- A wide variety of automatically generated scenarios to explore and test with robots in all kinds of conditions
- Optional challenges and activities to use robots in both conflict simulations and cooperative situations
- User supported library market of prefabs, working plans and robotic components purchased with the Enjin Platform
- Expansion of resources and tools available to users who subscribe or pay premium rates
- Narrative based adventures available to users that can be experienced individually or shared with a group
- Long term storage available to premium users for all robot teaching and learning (“Savable” robot brains)
- A capacity to serialize robotic designs to output directly to real world fabrication labs that deliver to the door
- Cosmetic input on robot design and appearance permitted on top of functional construction

Gamers

These are users who may use a free or paid subscription to engage in competition with robots that are primarily built from prefabricated designs and free or cheap components. Their interest lies mainly in fighting or exploring the world with their robots. Very useful data can nonetheless be gained from their use of these prefabricated robots and features with proper logging and monitoring of their results online.

Casual Hobbyists

These are users who enjoy the gaming aspects online of the virtual world but may also harbor an enthusiasm for custom construction of robots. They will engage in higher level design activities often experimenting with many different configurations of prefabs or custom components. Their experience and testing of these parts in all kinds of situations is also valuable in and of itself in furthering iterative design when they test these custom robots.

Social Users

These users are mostly interested in the interaction possible in an online world and finding social groups of people to share experience with online. Believe it or not, they can provide enormously useful feedback in the cosmetic design of robots tailored to look most appealing to society in general. By recording their selective choices we can build up databases of robot aesthetics that make robots more friendly appearing to all levels of society. Through their customization choices for their robots we can learn what it takes to make robots acceptable in many consumer, medical, nursing care, service industry and retail applications.

Combat Robot Competitors

These users mainly want to design and deploy robots to fight the robots of other users or robots we construct as opposition in the virtual world. They may want to perfect designs they intend to publish and pay to have constructed in real world hardware or to challenge and win against the designs of other users in the same medium. We can provide increasingly difficult challenges to these kinds of users by rewarding them when they defeat robots we intentionally deploy to test military and security scenarios. They might experiment with a variety of approaches that would prove to be superior tactics on the battlefield – like setting a swarm of cheap tiny agile robots against a large armored drone that seems otherwise unbeatable. The combined results of this arbitrary experimentation could prove to be very valuable to the military and other possible clients.

Advanced Robotics Designers

These users might be few in number but driven by the economic advantages of using our digital design environment to test and debug custom robots in order to solve many problems at minimal expense without having to mock them up in the real world. At some point if we are successful we could eventually draw many expert designers to our system or even host custom servers for them to operate inside a more secure environment. If we provide them with tools that might be cost prohibitive to develop from scratch we could become a de facto standard for early research and exploratory testing of theoretical designs.

IV. Git Merkle Tree + Blockchain Diagrams

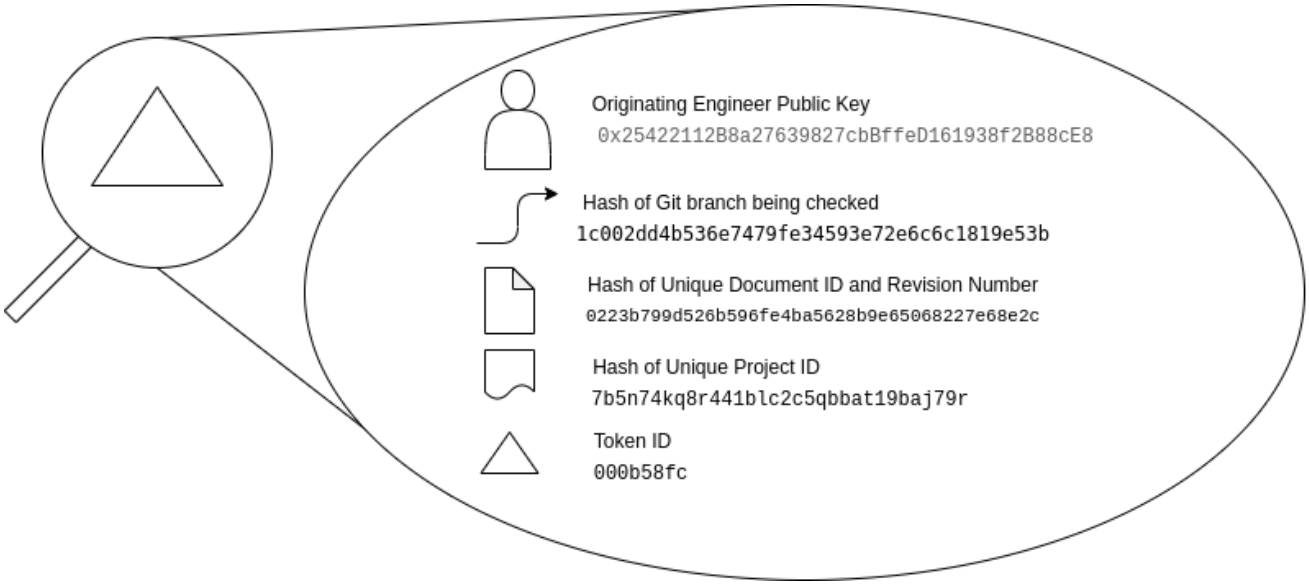

Figure 4.1: The engineering checking cycle begins with an Originating Engineer creating a document under the supervision of a Checking Engineer both of whom working under the direction of a Project Manager. When the Originating Engineer has originated a document according to required specifications to the best of his knowledge and competence he signs it and passes it on to the Checking Engineer. Using Git + Blockchain this creates the first token in the 'Ring of Authentication' Git branch which contains the above properties.

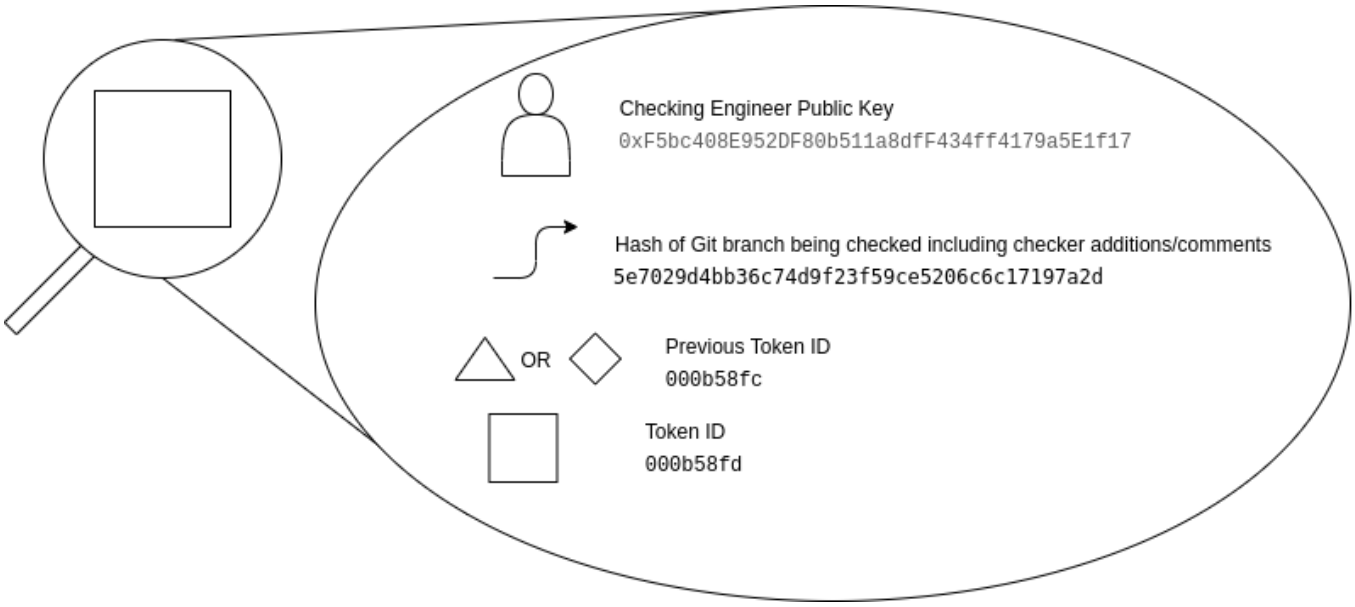

Figure 4.2: When the document has been originated and signed by the Originating Engineer the engineering checking cycle continues from the Originating Engineer to the Checking Engineer, who will be of higher competence and greater experience. The role of the checking engineer will be twofold: firstly he/she will correct any mistakes in the originated document, secondly he/she will add any further information and details outside of the originating engineer's range of expected competence. The Checking Engineer will mark up the originated document before signing it and passing is back to the Originating Engineer for revision. In this way the value of the Checking Engineer's competence and experience is maximised. Using Git + Blockchain this creates the second token in the 'Ring of Authentication' Git branch which contains the above properties.

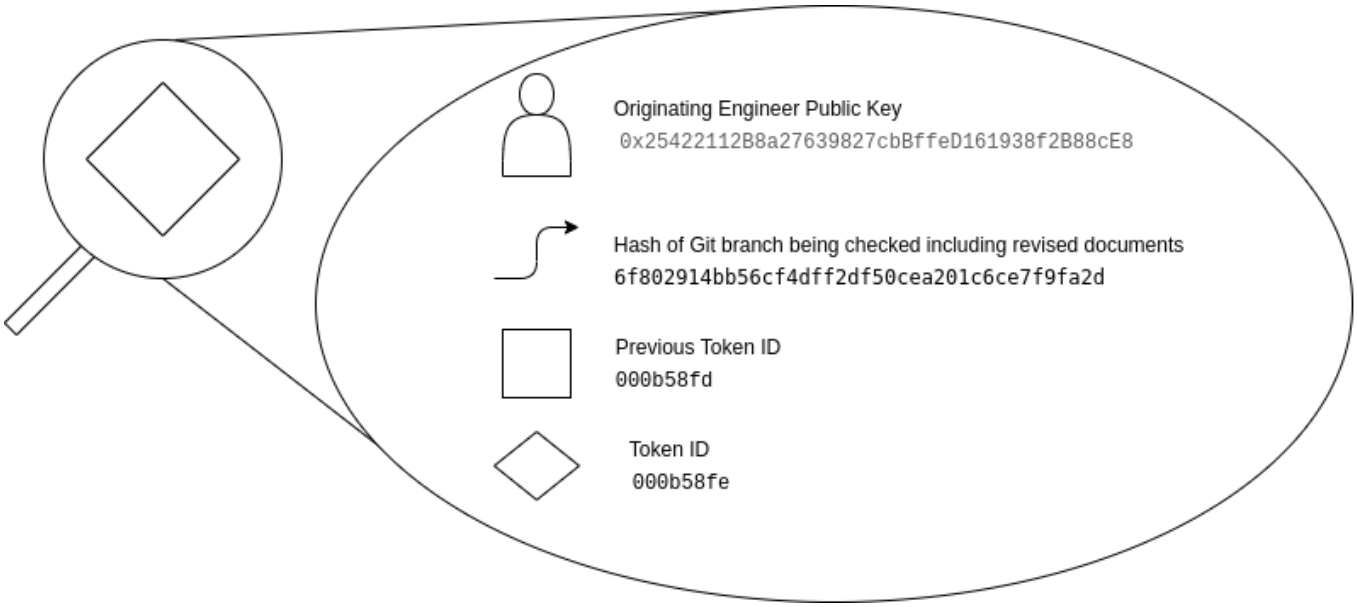

Figure 4.3: When the document has been checked and signed by the Checking Engineer the engineering authentication cycle continues back at the desk of the Originating Engineer who will revise the document by incorporating the comments and corrections of the Checking Engineer. If the Originating and Checking Engineer are working well together there should be only one revision, but the document can be checked and revised any number of times until the checking engineer is satisfied with the result. Using Git + Blockchain this creates the third token in the 'Ring of Authentication' Git branch which contains the above properties.

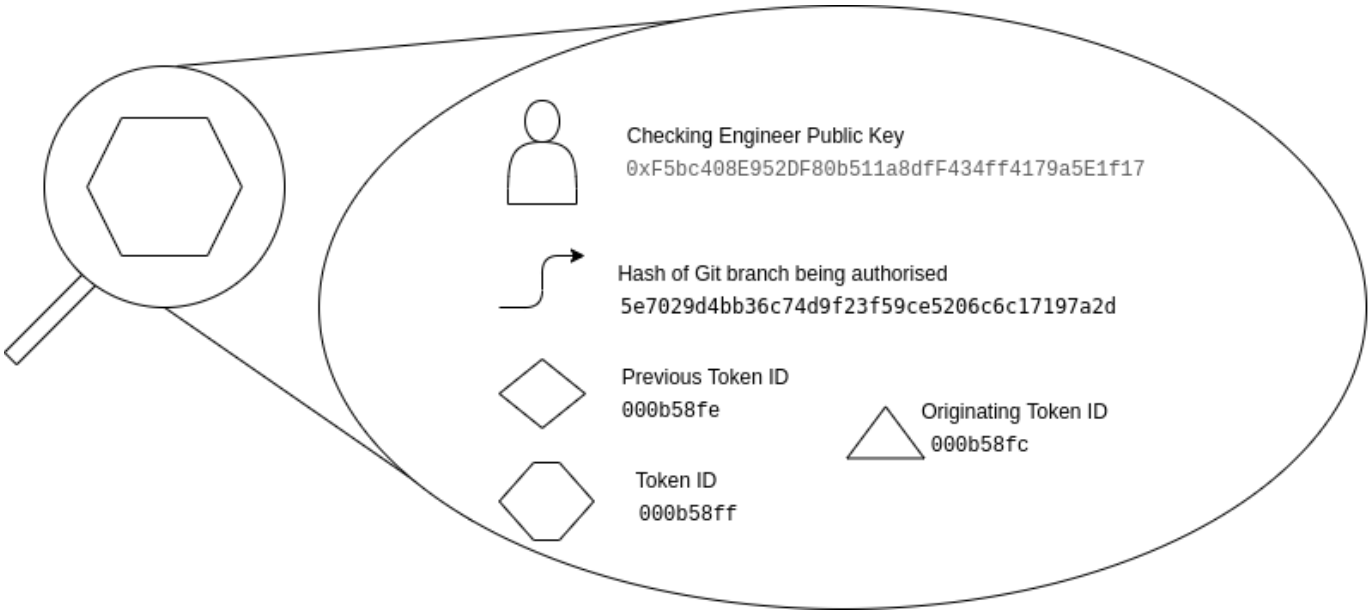

Figure 4.4: When the document has been revised by the Originating Engineer to the satisfaction of the Checking Engineer the Checking Engineer will authorise the document to be integrated into the broader project. Using Git + Blockchain this creates the fourth and final token in the 'Ring of Authentication' Git branch which contains the above properties.

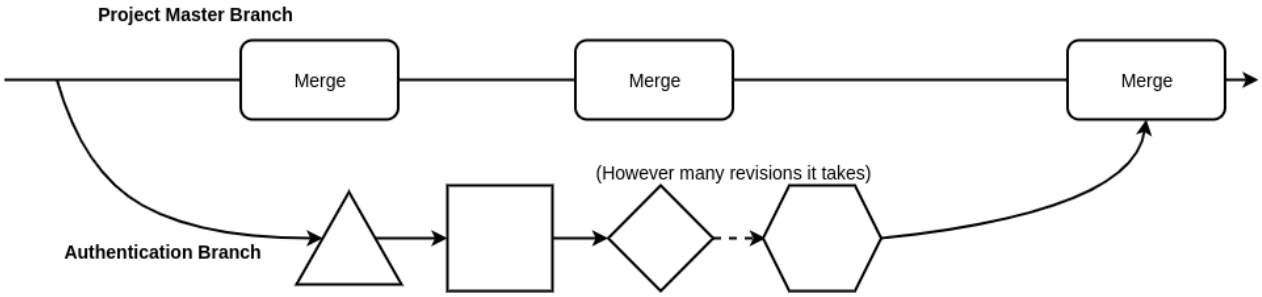

Figure 4.5: The tokenization of the engineering checking cycle creating the Rings of Authentication on the Development or Authentication branch of the project Git repository works as above. The system marries perfectly with Git's existing branching functionality and Merkle Tree data integrity framework.

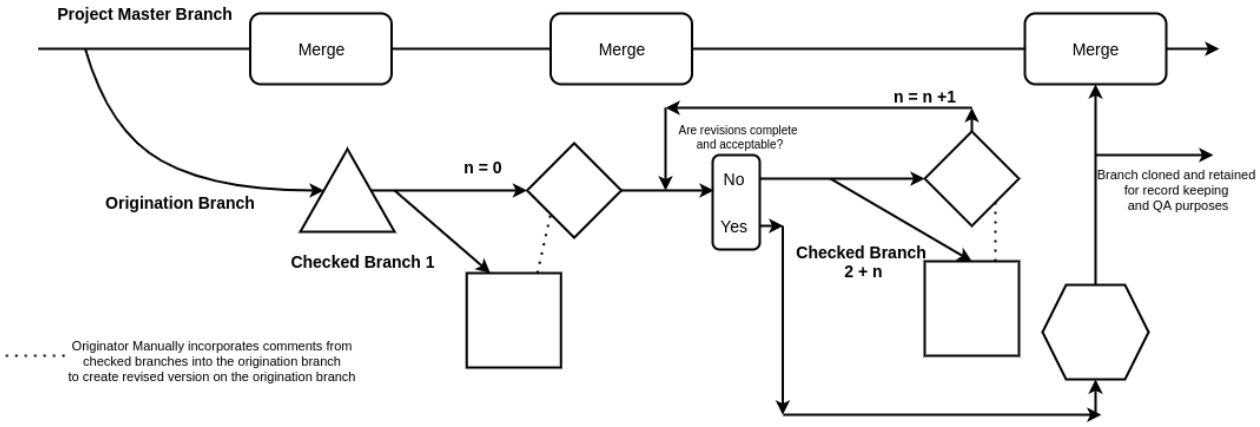
Project Master Branch
Merge
Merge
Merge
n = n +1
Are revisions complete and acceptable?
n = 0
No
Yes
Origination Branch
Checked Branch 1
Checked Branch 2 + n
Branch cloned and retained for record keeping and QA purposes
Originator Manually incorporates comments from checked branches into the origination branch to create revised version on the origination branch

Figure 4.6: Conceptual branching diagram demonstrating how the Checking and Originating Engineers collaborate according to the typical requirements of engineering documentation management. While it appears complex the only major difference between this and the use of Git in software source code development is that both the Checked revision is kept on a separate branch for quality assurance purposes and that the branch itself is cloned and retained prior to merge into the Project Master branch.

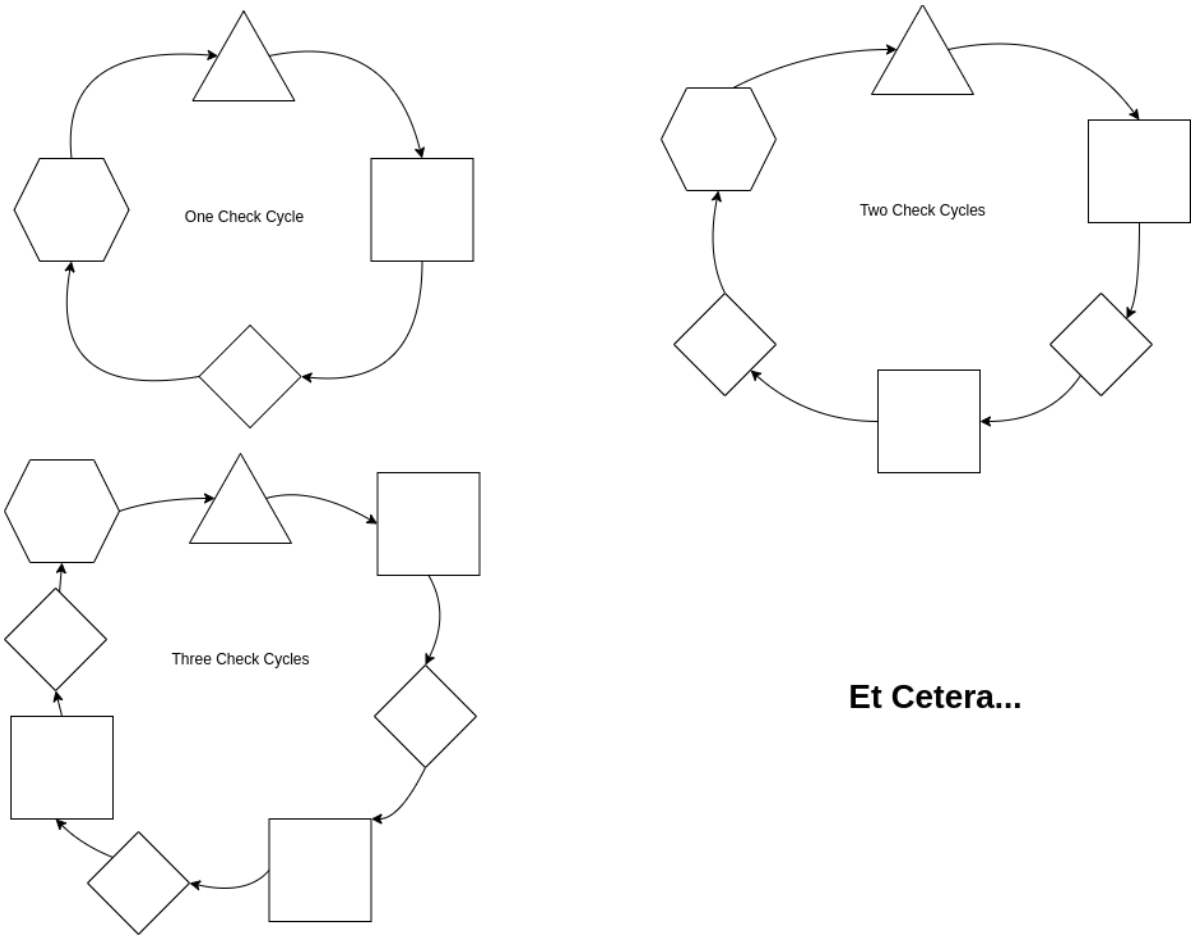

Figure 4.7: When an Originating Engineer and a Checking Engineer are working well together ideally there should never be a requirement for more than two checking cycles, checking cycles can continue indefinitely until the Checking Engineer is prepared to authorise the Ring of Authentication.

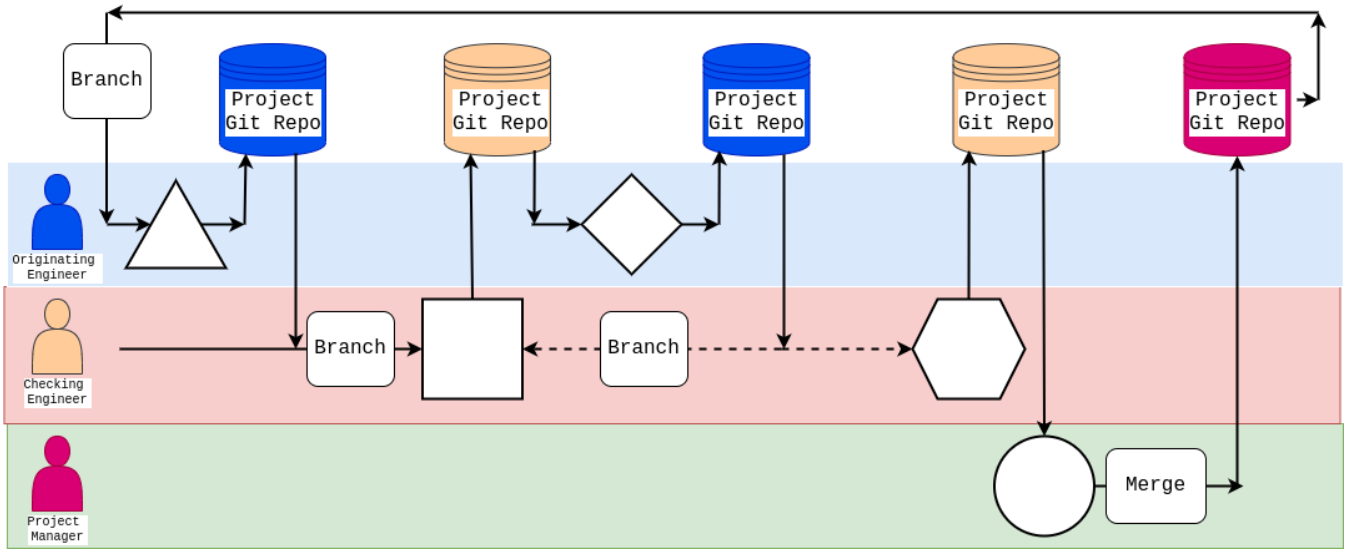

Figure 4.8: The Checking Cycle responsibility diagram. The Project Manager approves the final merge into the Master Branch of the Git Repository.

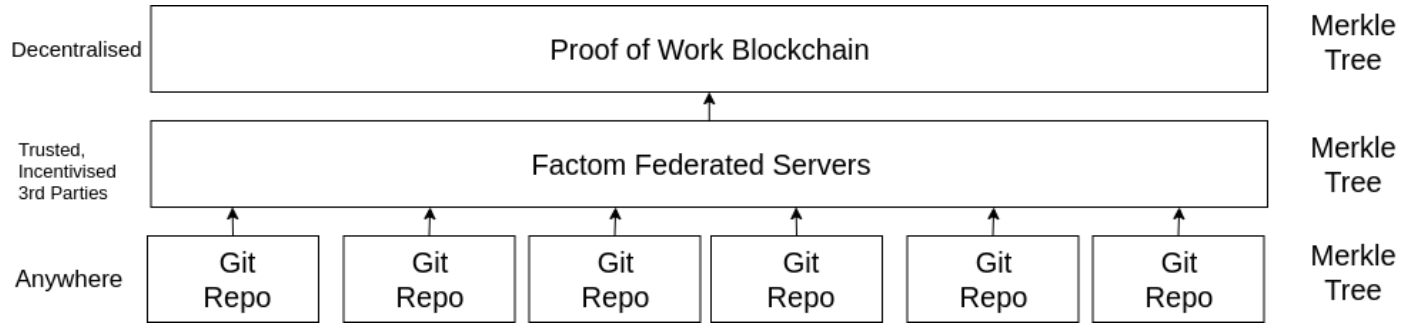

Figure 4.9: While RChain + RSpace offers a highly advanced Git + Blockchain integration with on chain repository storage and object capability access management, the design is robust and simple enough to work well with a basic Merkle Tree federated server solution such as Factom.

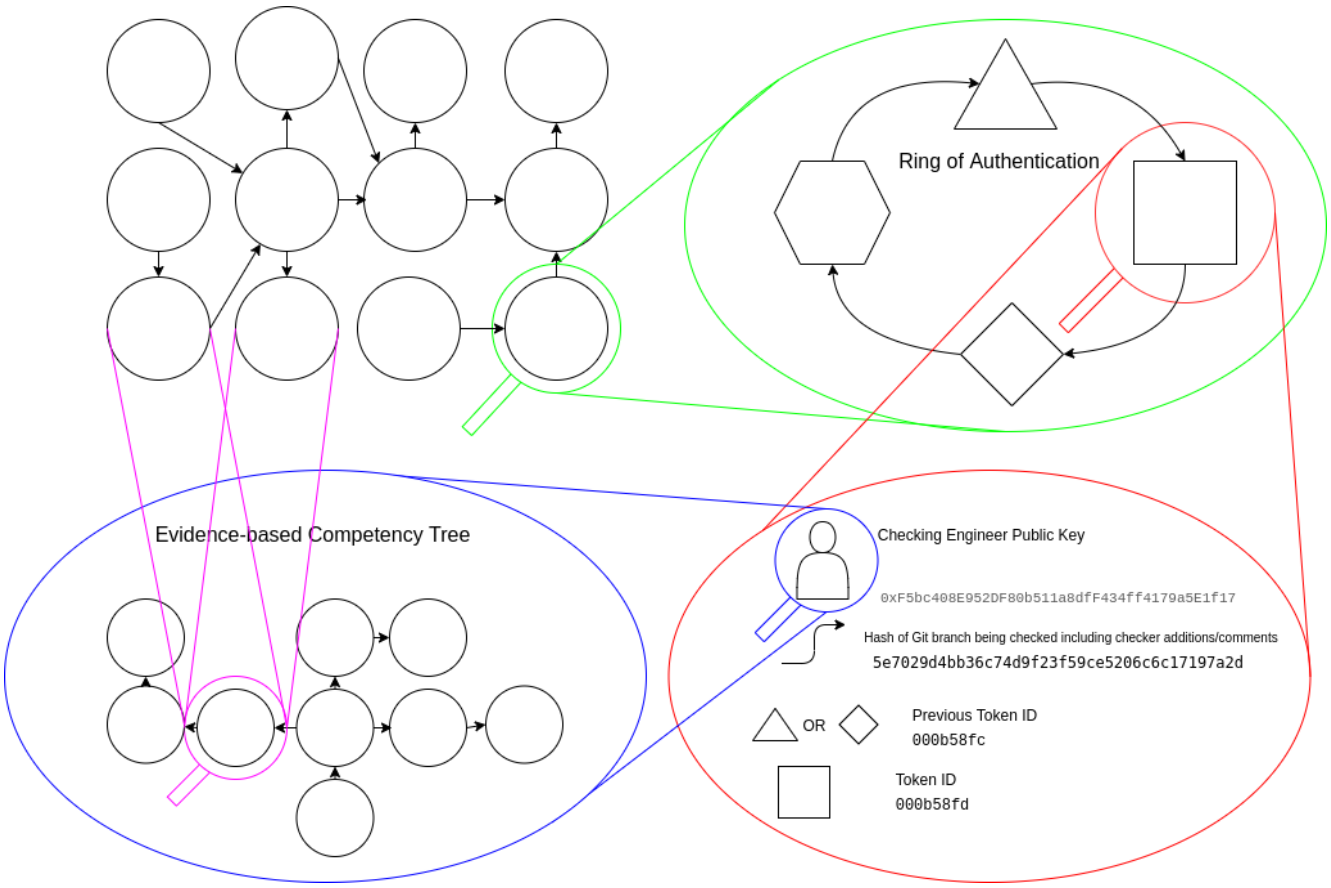

Figure 4.10: In tandem with ENGZIG, explained in section XIV which also uses Git + Blockchain but for professional competency, the process creates a virtuous circle of both refined and transparent quality assurance whereby the provenance of all engineering deliverables can be inspected and traced through a de facto Decentralised Acyclic Graph. This not only greatly improves the insurability of delivered engineering but also strongly discourages the stagflation of engineering signatures and engineered products and strongly encourages engineers to build up their competence, their experience and therefore their reputation in accordance with real world outcomes.

V. Git + Blockchain

Git is software for tracking changes in any set of files, usually used for coordinating work among engineers. It was initially developed for software engineers developing source code but its functionality can be used for LaTex and word processing files, CSV files, XML files and even CAD files in IFCXML format are beginning to emerge to leverage Git's functionality as part of ISO standards for Building Information Management. Git today can be thought of as a documentation management system as much as a code management system as many more people begin to understand how the software industry is able to collaborate seamlessly using this remote version control system. Git's documentation management goals include speed, data integrity, and support for distributed, non-linear workflows (thousands of parallel branches running on different systems).

Current Established Git Use Cases:

- Software Development
- Video Game Development
- Robotic Development
- Data Science and AI Development

Emerging Use Cases for Git:

- Collaborative Music Composition
- Building Information Management
- Engineering Documentation Management

Git was created by Linus Torvalds in 2005 for development of the Linux kernel, with the help of other kernel developers. Since 2005, Junio Hamano has been the central point of authority. As with most other distributed version control systems every Git directory on every computer is a full-fledged repository with complete history and full version-tracking abilities, independent of network access or a central server. [21]

In this way Git is similar to blockchain technology in that every machine contributing to the 'ledger' has a full copy of that ledger. The difference is that Git requires a central competent authority to approve all updates to the 'Main Branch' of the project. But outside of the main branch, work is free to continue in parallel, which enables scalable and robust collaboration. The Linux Kernel, the project for which Git was originally created to serve, accepts commits from over 12 000 software engineers globally and runs on billions of devices. Git is free and open-source software distributed under GNU General Public License Version 2 and is there free to use and free to be extended and expanded to include new functionality.

A major element that Git and all blockchains and DAGS have in common is content addressability. Content addressability means that each piece of data is uniquely identified by the contents of that data, as opposed to a sequential ID number or arbitrary label specified by a user.

For Git the commit ID of each commit is the hash of that commit object. This hash is calculated from all of the data that makes up that commit, including (but not limited to):

- File changes included in the commit
- File names of the committed files
- Committer name
- Commit date and time
- Commit message
- Parent commit ID

The commit object itself is identified by its own content.

A hash is the resulting output from a hash function. Hash functions can map arbitrary blocks of data to fixed-size output chunks, for example, SHA-256 always outputs a 256-bit result. A good hash always has uniform outputs: if you feed it randomly generated inputs, the outputs don't tend to "bunch up" in one part of all combinations of the output possibilities.

For our purpose of cryptographic hash functions, they have a few more requirements:

- The input should not be easy to obtain from the output.
- The output should change drastically in response to even a single change in the input.
- No two inputs should ever map to the same output.

Content-addressable systems are inherently resistant to tampering. To change one piece of data means updating every piece that references it, which in turn means every piece that references that, and so on. When using certain Git commands that rewrite history, such as `git rebase -i` or `git filter-branch`, even one change requires Git to recalculate every commit after the one that was changed, since each commit's identity depends on its parent.

In most of these systems, they create what's called a Merkle tree. A Merkle tree is a tree structure where each node of the tree has an identifier that's the hash of its contents. Git's object database is a Merkle tree and because of the referential nature of Merkle Trees, they are tamper-proof. [11]

The Merkle Tree structure maintains the integrity of both blockchain and DAG technology as well as Git. The beauty and simplicity of Merkle Trees as systems to maintain data integrity is that they can plug into each other by just extending branches ad infinitum. Thus Git's Merkle Tree can extend into any blockchain Merkle Tree trivially giving engineers on projects access to the power of either the Proof of Work of Proof of Stake consensus mechanism for their own work as opposed to blockchain and DAG technology being purely about finance or non-technical consumer focussed products such as collectibles of advertising.

Diagrams for a conceptual model of how this would work are presented in the previous section (Section XII). The model is based upon the typical engineering checking cycle, used by every engineering design house in the world globally today, and replaces ink signatures with the same PGP cryptographic signatures used to sign transactions on both encrypted Git repositories and blockchains themselves. The model assumes that engineers will have full control of their public-private key pairs, ideally stored on a personal hardware wallet. The model also assumes that every engineer is chartered or has obtained a PE certificate such that the work being signed is of commercially insurable quality.

The checking cycle creates rings of authentication for engineering documentation, each of which can be considered to be a block on a decentralised acyclic graph, this DAG of the rings of authentication builds the insurable project documentation structure.

Because Git uses a Merkle Tree structure it can be used effectively with as simple a blockchain integration as Factom [25], which stores chains of data within Merkle Trees on a shared system of decentralised federated servers. The root of the federated server Merkle Trees is pinned to either the Bitcoin or Ethereum blockchains depending upon the economics of the transaction fees at the time.

When projected documentation quality assurance is married with individual competency quality assurance with ENGZIG, a virtuous circle of transparent trust is created.

Of course, using commands such as `git rebase` or `git filter-branch`, would require re-authentication of previous over-written authentications, but because Git is available on a GNU license, between the user interface design and the re-design of Git for the specific purpose of engineering documentation management, this could easily be handled by a good engineering design team.

VI. ENGZIG

ENGZIG is a competency management tool utilising Git and blockchain in order to manage professional reputations in the same way that engineering documentation is managed [78].

In its simplest form it can plug directly into existing solutions such as Factom, but in a more complex form could store Git repositories using RChain RSpace.

In any case, the core premise is that transparent competency profiles for a variety of professions are created by those delivering the work to the highest quality in the real world. Rather than having bureaucratic institutions dictate competency requirements, the governance system will select for a balance between the most popular professionals who are most capable of achieving broad consensus and the most competent professionals most capable of *doing* what the competency map dictates.

The competence maps for any given profession will be public and fully transparent, essentially open source, and professionals will be able to clone them freely in order to create the template their own competence profiles or 'competence trees' which are analogous to 'skill trees' in video games like Final Fantasy XV or Resident Evil 6. These competency trees will be contained within a folder structure that aligns with the competency tree structure. It will use either XML or MD language to take full advantage of Git's ability to determine the difference or 'diff' between revisions of documents. All of this will come with a user interface that makes knowledge of both Git and blockchain technology unnecessary.

The unique value propositions are:

- Competency profiles for common skilled professions are not currently public, transparent and available in one place, making career choices difficult for both university students and minors.
- Because competency profiles are not public, adults themselves must rely upon imperfect information when making career decisions, which can have catastrophic consequences if they go wrong at any time.
- This asymmetry of knowledge gives Power Capital (as described by Nitzan and Bichler) undue influence and control over the lives of the general population and therefore democracy itself.

- Competency maps for some highly skilled engineering professions, such as Chemical Engineering, *aren't even specified* by the institution itself leaving professionals in the lurch between recruiters, HR, companies and Power Capital to determine what constitutes their profession.
- Without peer to peer lateral visibility of competence, it is very difficult for humanity to self-organise organically to build solutions to problems such as climate change.

VII. Penrose Tiling Games

1) The Necessity of Separating Concerns Between Resource Management Signalling and Information Signalling in Networks

In order to prevent blanket sequestration of predictive capability from networks by surveillance capitalists, Cre-Order saboteurs and AI Siren Servers it is necessary to create information sharing systems that throttle this sequestration and separate the concerns of information sharing from human resource (time and labour) management.

An analogous example from history the 'Phreaker Box' offers some insight into how and why our information networks operate in suboptimal ways today. [30]

Figure 7.1: A 'Blue' Phreaker Box on display at the Powerhouse Museum in Ultimo, Australia.

Before the resource management and the tonality of the telephones network were separated it was possible to secure free long distance telephone calls, credit on payphones, priority access on the military autovon network and various other resources using a technique called 'Phreaking'. Prior to the development of resource separation defences, the telephone system used tones in the existing voice lines to send routing instructions, and these tones were not filtered out at the handsets therefore allowing those with the understanding of how the network routed calls access to the resource management of the network itself.

A 'Blue Box' device would be able to send calls without the sender incurring costs, while a 'Black Box' device would be able to receive calls without the sender incurring costs. Other Phreaker Boxes were developed with their own specific purpose such as the 'Red Box' or 'Green Box' for mimicking the tones emitted when coins inputted into a pay phone. Apple Computers made 'Blue Box' devices and sold them on the grey market as a means to generate sales prior to the development of the Apple-1.

The Siren Server could be considered as the reductio ad absurdum of a global information network that lacks fundamental resource separation systems, with their users being subjected to industrialised Phreaking by Surveillance Capitalists in order to extract political and physical resources from them. Phreaking was originally a way for unscrupulous users to extract from the centralised network, Siren Servers are the inverse of this phenomenon and because it is their core business and they seek to extract from everyone in the entire network, it is a far bigger risk to society and the economy.

In response to Phreaking, Bell Telephones developed The Number 4 Electronic Switching System (4ESS) [31]. This simple switching system separated concerns between the messaging of the telephone network which managed resources and the tonality over which users communicated. What information networks need today is a similar system that allows users to share information with each other while throttling the sequestration of their information and behaviour from Siren Servers by filtering out the Phreaking signals. The simplest way to start is a white noise generator/filter. Penrose tiling, which produces an infinity of aperiodic tiling planes of infinite size, is a good candidate for this purpose.

2) Penrose Tiling Background

Penrose tiling games are a potential remedy and solution to this problem. There are an infinite number of possible Penrose tiling planes and each Penrose tiling plane extends to infinity. It is impossible to ascertain by inspection from any section of any plane which of the tiling planes the visible section is a part of and it is also impossible to predict the continuation of any tiling pattern on any plane beyond the Phi ratio. This property of Penrose tiling has the potential to heavily throttle sequestration of predictive capability by Siren Servers because no AI is capable of predicting the outcome of any pattern better than Phi.

Penrose tiling is a form of aperiodic tiling based upon 5-fold symmetry developed by Roger Penrose in the 1970s. The first such tiling (P1) developed by Penrose featured four shapes: A pentagram, a pentagon, a 'jester's hat' and a rhombus.

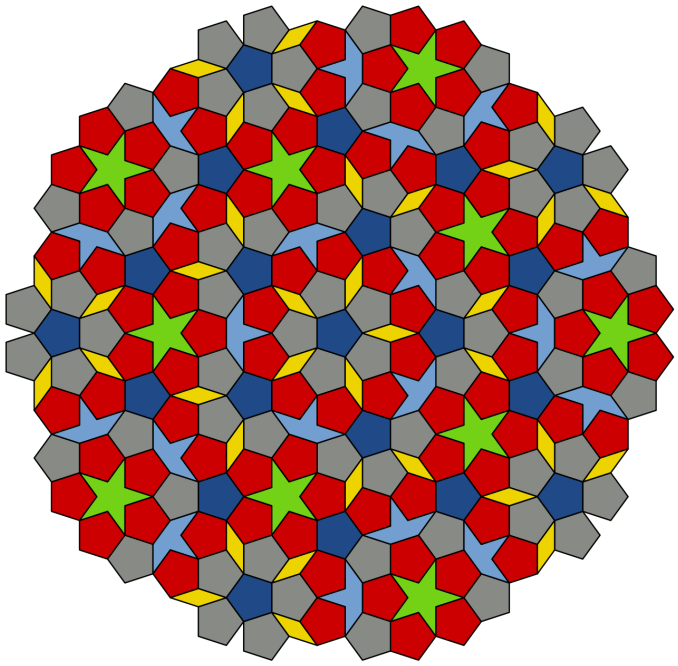

Figure 7.2: Penrose P1 aperiodic tiling.

The second tiling developed by Penrose simplified the pattern to two tiles: a kite and a dart formed according to the geometric rules in figure 15.3.

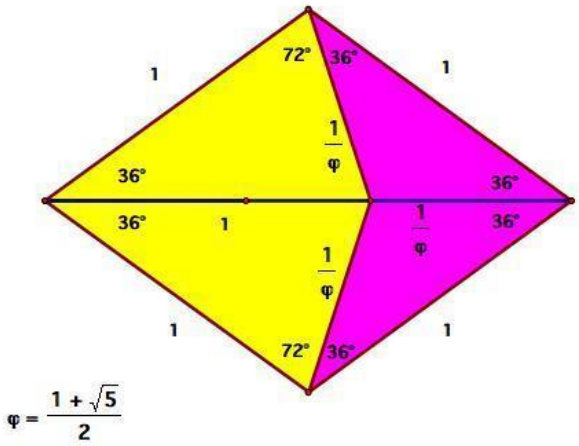

Figure 7.3: How Penrose P2 aperiodic tiling kites and darts are fashioned from a larger rhombus.

The vertices of the kites and darts in the Penrose P2 tiling must be connected head to tail according to the rules in figure 15.4.

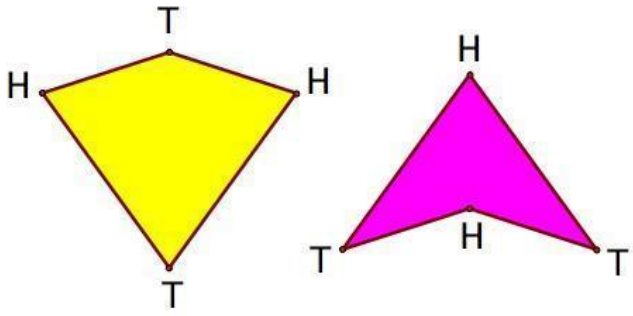

Figure 7.4: Penrose P2 aperiodic tiling kites and darts must be connected with head vertices (H) adjoining tail vertices (T).

In addition to these matching rules, on a broader scale the tiles must match to form one of seven possible shapes shown in figure 15.5.

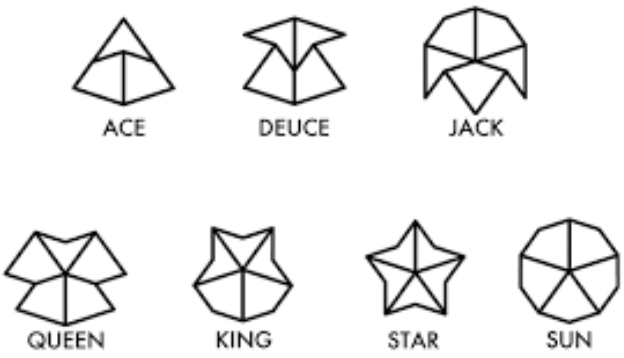

Figure 7.5: In addition to the head to tail rules of Penrose P2 aperiodic tiling the kites and darts must be connected to create one of the above seven bigger shapes.

The asymmetric tiling result is shown in figure a below.

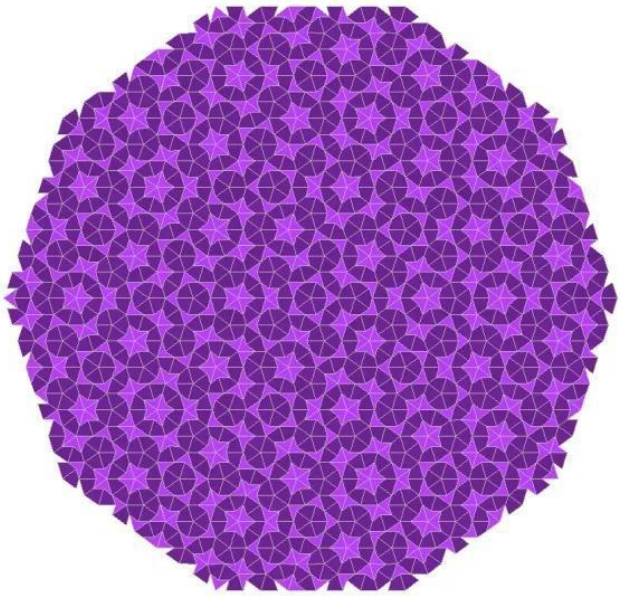

Figure 15.6: Penrose P2 aperiodic tiling.

The third Penrose tiling pattern (P3) uses a pair of rhombuses with equal sides but different angles as shown in figure 15.7. Rhombus-shaped tiles can be used to tile the plane periodically, so additional rules apply in order to tile the plane periodically. This simplest way to visualise these rules is shown in figure 15.8 whereby the notches and coloured lines must match up and align in order to achieve the final result shown in figure 15.9.

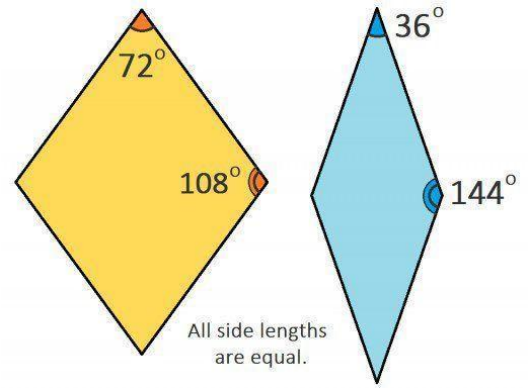

Figure 7.7: The rules for the creation of the fat and thin rhombus necessary to create Penrose P3 tiling.

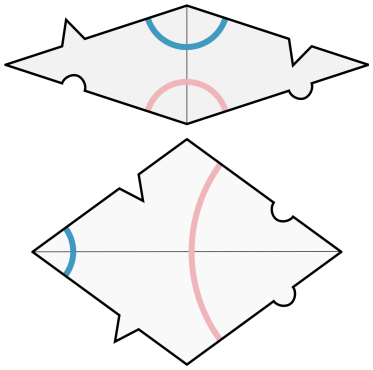

Figure 7.8: The rules for the allowable adjoining between the sides of the rhombi of Penrose P3 tiling are best described visually as above.

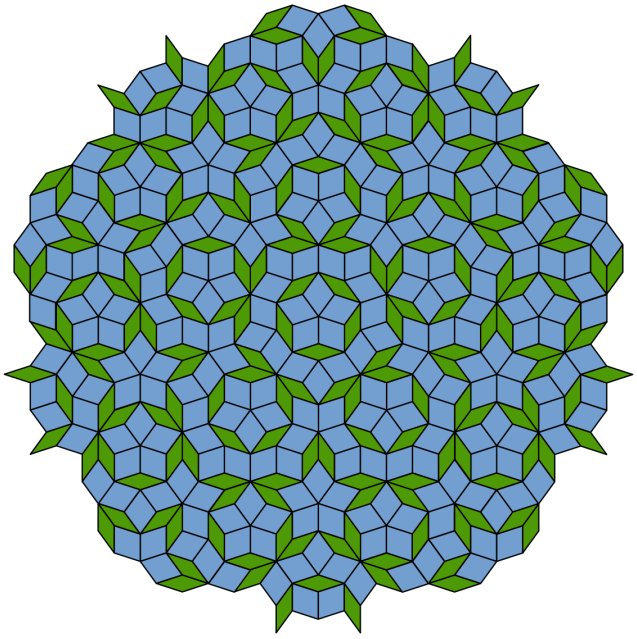

Figure 7.9: Penrose P3 aperiodic tiling.

The ratio of kites to darts and fat rhombi to thin rhombi in the P2 and P3 tilings both tend towards Phi as the area of the tiling plane tends towards infinity. A number of other features of these tiling planes tend towards Phi, or multiples of fractions thereof, including the ratio of fat to thin parallel sections across any one of the five vertices of symmetry. [10]

$$\lim_{N_{tiles} \to \infty} \frac{N_{kites}}{N_{darts}} = \phi$$

$$\lim_{N_{tiles} \to \infty} \frac{N_{fat}}{N_{thin}} = \phi$$

Figure 7.10: The ratio of kites to darts in Penrose P2 tiling and fat to thin rhombi in Penrose P3 tiling approaches Phi as the number of total tiles, and therefore the area of the plane, approaches infinity.

3) OK, So What?

Despite $multibillion market capitalisations and valuations blockchain solutions such as Ethereum and Bitcoin failed in their vision to create a diverse suite of decentralised applications and engaging consumer use cases. There is no decentralised freelance market, no decentralised Uber, no decentralised Netflix nor media marketplace nor decentralised social media. In order to

achieve a viable business solution many blockchain solutions layer centralised systems on top of blockchain systems, which diverge from the purpose and the vision, diluting the effectiveness of original conceptual purpose that has propelled the technology into the mainstream mass consciousness.

In addition to this, while the delivered products have failed with respect to the original vision, the expectations of what blockchain technology can achieve amongst the communities of 'visionaries' and 'thought leaders' and corporate B2B salespeople have expanded to include visions such as insurance contracts, international trade and financial settlement, oilfield E&P reserve management, ending sweat shop and forced labour and saving the oceans and rainforests amongst many others. While the expectations have expanded far beyond what was originally promised when Ethereum was announced in 2014, the engineering consumer product delivery has flatlined and cratered to a narrow suite of ERC token contracts, which cannot even retain metadata for use cases such as art and music, and flagrant social media hyping with the help of pre-existing Cre-Order capital for 'art' and 'collectibles'.

While Ethereum is extremely limited in its capability to achieve smart contract complexity, RChain's Rholang, which is correct by construction with inherent expression of concurrency, parallelism and process calculus allows for high integrity complex smart contracts in addition to on chain data storage and 40 000 transactions per second across the network. In order to utilise blockchain technology fully, efficiently and effectively the processes of wealth generation need to be built on chain from the ground up, which requires complexity.

Tokens are only valuable in so much as they are able to signal and represent real world existential value i.e labour and productivity of both machines and people. If Ethereum were physically able to represent the complexity necessary to represent fundamental value its market capitalisation would be able to be of at least the order of magnitude of outstanding global debt, equities and derivatives ($1 quadrillion ($10^15)). Despite its successes, as it stands Ethereum is four orders of magnitude away from achieving this goal, and without the necessary smart contract complexity it will not be able to.

Since the announcement of Ethereum in 2014 there has been much speculation around how the Ethereum blockchain could make the sharing of information safer and more secure. The original Decentralised Autonomous Organisation (DAO) was created as a means to secure funding for a variety of projects with smart contracts proposed to handle resource allocation and governance. While the DAO had noble and laudable goals it collapsed at the first hurdle due to the inherent fragility of the Solidity smart contracting language.

In addition to this a variety of ICOs raised millions of dollars in order to build a diverse array of decentralised 'token economies' from Singularity DTV for the exchanging of audiovisual media to BitJob for the exchanging of student internship labour to Synereo which aimed, somewhat unrealistically in hindsight, to replace Facebook with a decentralised social network. All of these projects failed leaving investors with neither a product nor a token with any marketable valuable.

Enjin Platform enjoyed moderate success with their ERC-1155 token standard and ERC-20 EnjinCoin as 'crafting material' for items on their platform, which is intended for developers to raise funds for development and for the players to have more tangible ownership of their game items. [42] Games utilising the platform, such as Age of Rust, will start to be released in 2021. Enjin's marketing vision is very interesting: a 'Multiverse' whereby items can be exchanged between different games according to the rules of those games. The combination of a solid basic product and this grand long term vision has given EnjinCoin a strong market price, some strong enterprise partnerships and an avid following amongst blockchain gaming enthusiasts.

The difficulty with this Multiverse concept in execution, however, is that every individual game developer must, at the time of writing this paper, make individual deals with other game developers on an item by item basis. While the Multiverse vision helps EnjinCoin's market price and Enjin Platform to expand its enterprise relationships, it leaves ecosystem game developers with the awkward and time-consuming job of making good on the vision. Thus the Makerverse project, led by Patrick Mockridge and described in section III of this paper, switched from the Enjin Platform to RChain.

4) Penrose Tiling Games as Universal Information Sharing Mechanism Base Layer on the Decentralised Internet

Because of the inherent insecurity of the Solidity smart contracting language, the ERC-1155 contract developed by Enjin took over twelve months to deploy into production on the Ethereum blockchain with a full time team of 6 Enjin developers plus the help of the Ethereum community.

A replica of this contract in Rholang was developed and deployed to the RChain Mainnet in less than a week by Raphaël Charli alone. This token standard is called RChain Token. One of the first test cases for this token

was a multiplayer hexagonal tiling game developed in the DAppy browser by Raphaël Fabre.

If instead of using hexagonal periodic tiling of a single tile type, users are minted thin and thick Rhombi of Penrose P3 type geometry in the Phi ratio and place tiles on a game board according to the rules of Penrose P3 tiling then it is impossible for any third party to predict the outcome of any game mechanic better than the Phi ratio. Thus Alice, Bob [43] and any number of additional participants can play with each other without Mallory or Eve gaining a meaningful edge on their group sharing activity. Google recently calculated Phi to 31.4 trillion decimal places, setting a new world record, however the % edge vs a widely publicly available 20 thousand decimal places is so vanishingly small such as to be immaterial.

The exact game mechanics dictating winning and losing within the Penrose tiling game are immaterial as the beauty of tiling games is that many rules can be layered on top: dominoes, making specific shapes, playing cards and mixtures thereof are all possible. The main thing about Penrose tilings is that they resist malicious eavesdropping and sequestration from brute force attackers using artificial intelligence to gain an edge.

And because RChain's Rholang [44] smart contracting language is built to handle complexity and on-chain storage, it could be possible to store valuable information within these tiles, such as artwork, game items, music or even Git repositories. Users could stake their own information in order to gain from others in ways that are both reasonably predictable in the aggregate and reasonably safe in the specific with each player sharing according to their own personal situational preferences and risk-reward appetite.

And in this way, with a robust base layer mechanic for sharing and trading secrets, Enjin's concept of the blockchain gaming 'Multiverse' becomes much more attainable for game developers and players. Just like businesses rely upon the stock market for liquidity of their equity, so game developers and players can take advantage of the naturally robust marketplace offered by the properties of Penrose tiling to move around the gaming 'Multiverse'.

In addition to this, high transaction rates from real users help to stabilise Proof of Stake DAG networks. Penrose Tiling information sharing games offer a way to rapidly scale transaction rates and stabilise the network

VIII. Polyomino Tiling Games

Polyominoes have been used in popular puzzles and games since 1907, the most famous and popular of which is the 1984 tile matching video game Tetris developed by Alexey Pajitnov while working for the Dorodnitsyn Computing Centre of the Soviet Academy of Sciences, a Soviet R&D center. But the magic of Polyominoes in games and puzzles is not limited to Tetris, there are hundreds of board games employing the tiling features of Polyominoes in existence today. As with periodic and aperiodic tiling games, a wide variety of game mechanics can be layered on top of Polyomino tiling properties. A Polyomino factory on RChain is an exciting candidate for another base layer game mechanic in order to stimulate sharing and interaction of information with others and thus increase the transaction rate and the stability of the Casper Consensus mechanism.

$$A_n \sim \frac{c\lambda^n}{n}$$

Figure 8.1: The number of polyominoes able to be created from any given square or order n scales hyperbolically according to the above equation. According to current human knowledge $\lambda = 4.0626$ and $c = 0.3169$, although the full mathematical proof is not yet known.

The beauty of Polyomino games in a world of artificial intelligence is that the enumeration of Polyominoes expands hyperbolically according to the dimensions of the square from which they are formed. Figure x1 shows the enumeration of polyominoes up to a square of order 5. These Polyominoes are extremely useful for tiling games between human players. But what if AI is being used to gain an edge in game play? In this case the magic of Polyominoes comes into its own. The limit of human knowledge of enumeration of Polyominoes is for a square of order 56, which yields approximately $6.9X10^{31}$ individual tiling pieces. Therefore, using these higher order Polyominoes with a simple injection of randomness using any simple game mechanic will not only greatly exceed the possible outcome limit of chess (10^{123}) but also Go (10^{360}) and therefore neuter any potential edge that artificial intelligence could gain over a random number generator. [5] [23]

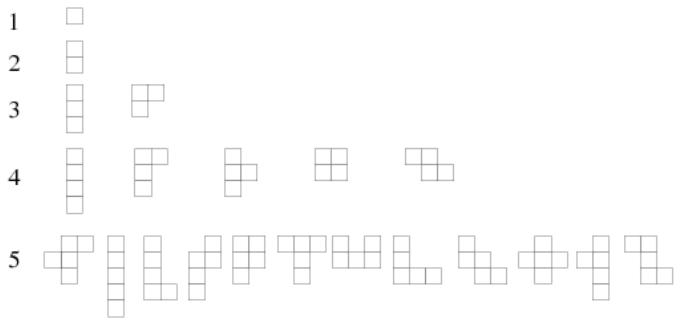

Figure 16.2: Polyominoes up to order 5 are common in board and puzzle games. The reader may recognise fourth order polyominoes from the popular video game Tetris.

Therefore the Siren Server business model is potentially rendered useless and obsolete with a few simple game mechanics. In addition to this transaction rates on Proof of Stake blockchains can be stimulated to the necessary level to achieve stable and robust Casper Consensus. All this can be achieved quickly at low cost with minimal quality assurance burden because of solutions like RChain.

IX. Syngenegraph

Figure 9.1: The vision created by this paper, Syngenegraph, changes the perception map of available phase space for taking action to solve problems to something much more engaging and clear. Art on the yellow square courtesy of Nicholette Wojtasik (Yung Ramen) [26].

With the cost of autonomous manufacturing lowered by 90-95%, it becomes available to any community or middle class individual with access to capital. Aliens from Saturn are replaced by the most clearly live and clearly serialised financial channel which is Bitcoin. Siren Servers are replaced with Factom which acts neutrally and predictably. With Git + Blockchain via Factom teams can get all the benefits of the public validation of Open Source working practices while still keeping their work secret and proprietary and are, therefore, able to capitalise upon it.

Makerverse elevates gaming to something more professional and gives low cost, much fairer direct blue square access. The yellow square via Penrose and Polyomino tiling games stays safe from violence, meta-violence and sequestration and becomes more about pure creativity and expression than conflict.

ENGZIG provides the identity management gateway between squares outside of pure engineering quality assurance via Factom: giving a safe, robust and secure route through the network via a digital identity that is genuinely personally valuable and therefore an asset.

This new vision, encompassing engineering quality assurance; universal ownership of the autonomous means of production; universal competency-based self-sovereign digital identity; universal access to engineering simulation and white noise filters for individual creatives to protect themselves from Siren Server data sequestration we term **Syngenegraph**.

Syngenegraph is a portmanteau of three words:

- Synergy: in that the whole is greater than the sum of the parts.
- Generate: in that the whole purpose is to equip as many people as possible to be able to build and create.
- Graph: in that people can plot and map where they are in relation to where they want to be relative to society and their own creative and personal goals as accurately as possible.

This map gives the 39 million future leaders needed to implement the Great Reset agenda safely and sustainably and a clear vision and clear steps viable to take in order to take full responsibility for themselves and their communities, which our current prevailing fake news map (figure 1.1) does not allow for.

X. References

1. **Peter Thiel and Blake Masters: Zero to One: Notes on Startups, or How to Build the Future, ISBN-10: 9780804139298**
2. **Jonathan Nitzan, Shimshon Bichler, Capital as Power: A Study of Order and Creorder, ISBN-10 9780415496803**
3. **Jaron Lanier: Who Owns the Future?, ISBN-10: 0241957214**
4. **Capital as Power: Toward a New Cosmology of Capitalism: https://capitalaspower.com/**
5. Solomon W. Golomb: Polyominoes, ISBN-10: 0691085730
6. Jeremy Beal: An to Rho Calculus: http://blog.rchain.coop/2018/07/17/intro-rho-calc/
7. Daniel Robles, 2018, CoEngineers White Paper Revision 2.1, DRAFT PREVIEW ONLY, https://coengineers.io/publications/CoEngineers_Whitepaper.pdf
8. **Daniel Robles: Blockchain For Engineering Professions - ASCE Grand Challenge Presentation: https://youtu.be/LQzF6g3L6Oo**
9. Daniel Robles: The Revolutionary Blockchain – An Opportunity for Engineering Stewardship (American Society of Civil Engineers Grand Challenge Contest Winner; Best Value – IoT): https://www.scsolutions.com/wp-content/uploads/2017-03-01_BlockChainEngrStewardship_RoblesBowers.pdf
10. Wikipedia: Penrose Tiling https://en.wikipedia.org/wiki/Penrose_tiling
11. **The Distributed Nature of Git and Bitcoin (Initial Commit): https://initialcommit.com/blog/git-bitcoin-distributed-nature**
12. **Wikipedia: Merkle Tree https://en.wikipedia.org/wiki/Merkle_tree**
13. Kumar Swapnil: Understanding Merkle Trees (Code Story) https://medium.com/codestory/understanding-merkle-trees-f48732772199
14. Wikipedia: Zero-Sum Games: https://en.wikipedia.org/wiki/Zero-sum_game
15. MIT Technology Review: Technology Stalled in 1970: https://www.technologyreview.com/2014/09/18/171322/technology-stalled-in-1970/
16. The World Economic Forum: The Great Reset: https://www.weforum.org/great-reset/
17. Nikolai D. Kondratieff: The Long Waves in Economic Life, ISBN-10: 1614276978
18. Joe Rogan Experience #1558 - Tristan Harris: https://youtu.be/OaTKaHKCAFg
19. Center for Human Technology: https://www.humanetech.com/
20. Lex Friedman and Eric Weinstein: https://youtu.be/o2nG7-eXxko
21. Wikipedia: Git: https://en.wikipedia.org/wiki/Git
22. ENGZIG: The future of career management: https://vimeo.com/169265783
23. Wikipedia: Polyominoes: https://en.wikipedia.org/wiki/Polyomino
24. **Supporting Lecture Series by Patrick Mockridge: https://www.youtube.com/watch?v=Wgxw0WTkeyA&list=PLS0PrDysL4A3r9Ntdb159vsT2lmQK3zAW**
25. Factom: https://www.factom.com/
26. Yung Ramen: https://www.facebook.com/plebmilk
27. Wikifactory: CubeSpawn: https://wikifactory.com/+cubespawn
28. **James Jones: How Changing Manufacturing Can Change the World | TEDx Sugarland, Texas https://youtu.be/hFhWx6bYlBc**
29. The Robotic Operating System: https://www.ros.org/
30. Wikipedia: Phreaking: https://en.wikipedia.org/wiki/Phreaking
31. Wikipedia: No. 4 Switching System: https://en.wikipedia.org/wiki/No._4_Electronic_Switching_System
32. Wikipedia: Object-Capability Model Permission Security: https://en.wikipedia.org/wiki/Object-capability_model
33. **Wikipedia: Jaron Lanier: https://en.wikipedia.org/wiki/Jaron_Lanier**
34. Investopedia: Tobin's Q: https://www.investopedia.com/terms/q/qratio.asp
35. **Wikipedia: Process Calculus: https://en.wikipedia.org/wiki/Process_calculus**
36. Bitcoin Wiki: Genesis Block: https://en.bitcoin.it/wiki/Genesis_block
37. UK Health and Safety Executive: Control Of Major Accident Hazards (COMAH): https://www.hse.gov.uk/comah/
38. UK Health and Safety Executive: ALARP Risk Management: https://www.hse.gov.uk/managing/theory/alarpglance.htm
39. Wikipedia: Internet of Things: https://en.wikipedia.org/wiki/Internet_of_things
40. Wikipedia: The Dunbar Number: https://en.wikipedia.org/wiki/Dunbar%27s_number
41. The World Economic Forum: The Great Reset: https://www.weforum.org/great-reset/
42. Enjin Platform White Paper:

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjklIa64JnvAhW3TBUIHUGmCcIQFjAAegQIARAD&url=https%3A%2F%2Fenjin.io%2Fwhitepaper&usg=AOvVaw3Dz9-S47PbD1ioO5CbyM0O

43. Wikipedia: Alice and Bob: https://en.wikipedia.org/wiki/Alice_and_Bob
44. Rholang: https://rchain-community.github.io/

***important references highlighted in bold**